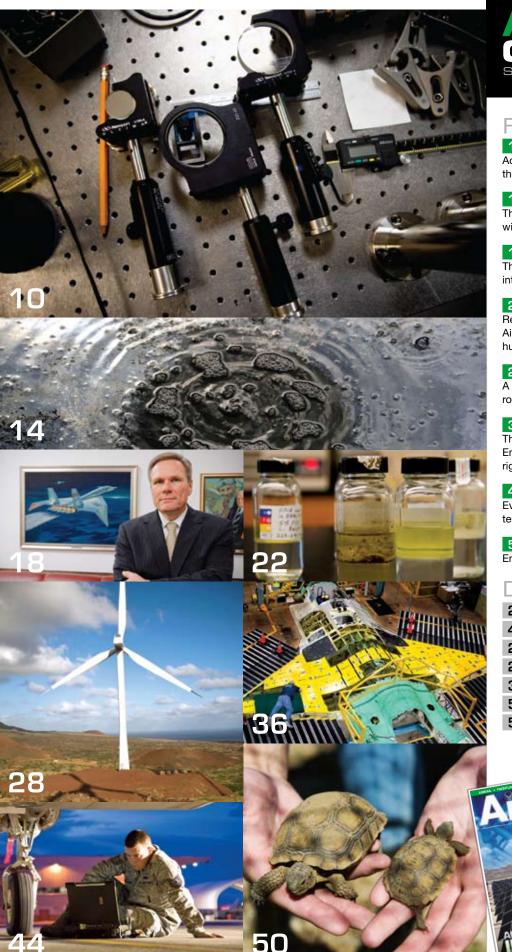


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On the Cover

Dr. Werner Dahm, Air Force Chief Scientist, directs research programs with a budget of approximately \$2 billion. The Air Force is developing ways to make the service more capable and efficient through research and innovation

> photo illustration and design by G. Patrick Harris

COMMENTS

Got something to say about Airman? Write us at airman@dma.mil, or visit www.AIRMANonline.af.mil, to share views with fellow readers.



THE BOOK 2009

Folks.

Congrats on another great edition of "The Book." [The Book, 2009]. It is a very useful reference document and I look forward to it each year.

I do have a question for you regarding the fold out map of Air Force Facilities. What is the significance of the nine regions? What determined which state was in which region and are the regions used for anything else? Thanks again for a great publication.

Jim Wessler ACC/IGIO Langley Air Force Base, Va.

zangioy / iii / croo zace, var

Editor's Note: The nine areas on the map were simply a way to break up the bases and make them easier to find on the map. Our designers used color coding and the area numbers so that people looking at the map could easily locate the base information in the text.

"PUSHING THROUGH"

Airman Staff,

It is good to read about my Aerial Port team members still toughing it out [July-August 2009]. "Pushing through," as we used to say.

Tom Barto

Reprinted from the AirmanMagazine fan page on Facebook

Editor's Note: The team we sent to Travis Air Force Base, Calif., had a great time interviewing the aerial porters. Active duty and Reserve Airmen work hand-inhand there to send tons of equipment and thousands of people each year to locations around the world. There is lots of work and little recognition for them as they "push through." We hope our efforts will shed some light on these outstanding Airmen.

IN GENERAL

Good Afternoon,

I love Airman magazine; always have. By the way, I'm lucky enough to be living just a few doors down from retired Brig. Gen. Ed Robertson, former director of public affairs, Office of the Secretary of the Air Force, out of the Pentagon. He's a great man ... and he loves Airman magazine, too!

Douglas Blackley

Reprinted from the Airman Magazine fan page on Facebook

Airman magazine keeps me abreast of our latest developments and makes this old

retiree feel like I am still a vital part of the force.

Kenneth David Gunn

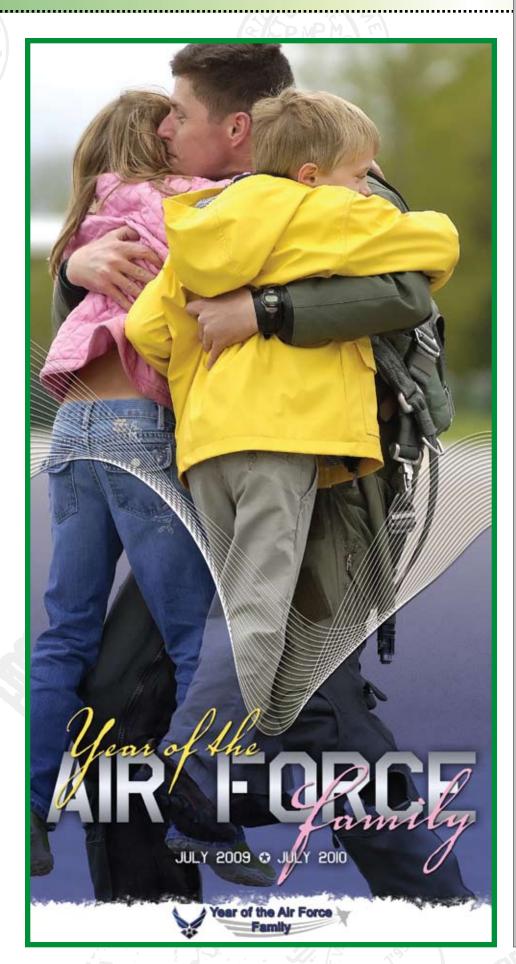
Reprinted from the AirmanMagazine fan page on Facebook

I have always enjoyed reading Airman. It was one of the first things I did when I attended drill at McChord Air Force Base, Wash. After my four years active and 11 years out and another 22 in the Reserve I have read quite a few issues. They really let us know what was going on in the service. Keep up the work.

Jerald D. Tobin

Reprinted from the AirmanMagazine fan page on Facebook





Airman

Official magazine of the U.S. Air Force September-October 2009, Volume LIII, Number 6

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Commander DMA - San Antonio
Deputy for Public Affairs Operations

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Col. Les Kodlick
Col. Clifton Douglas Jr.
Jeffrey L. Whitted

AIRMAN STAFF

Senior Editor James B. Pritchett

Associate Editor Tech. Sgt. Matthew McGovern

Associate Editor Staff Sgt. J. Paul Croxon

DESIGN STAFF

Design Director
Deputy Design Director
Designer
Designer
Designer
Designer
Production Manager

Designer
Production Manager

Andrew Yacenda

CONTRIBUTORS

Copy Editor Mike Kinchen
Copy Editor Steve Richards
Copy Editor Janie Santos

ABOUT AIRMAN

Airman is published bimonthly by the Defense Media
Activity for the Secretary of the Air Force Office of Public
Affairs. As the official magazine of the U.S. Air Force,
it is a medium of information for Air Force personnel.
Readers may submit articles, photographs and artwork.
Suggestions and criticisms are welcome. All pictures are
U.S. Air Force photos unless otherwise identified.
The opinions of contributors are not necessarily
those of the Air Force.

EDITORIAL OFFICE

Airman, DMA-San Antonio, 203 Norton St., San Antonio, TX 78226-1848 Telephone 210-925-7757; DSN 945-7757, fax 210-925-7219; DSN 945-7219 E-mail: airman@dma.mil

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Fronfo AIRMEN HONE DIVERSE SKILLS

Airmen train constantly to develop and hone skills necessary to successfully and safely execute the wide range of operations conducted by active-duty, Guard and Reserve Airmen. Missions range from launching satellites to providing front-line, emergency medical care to allies. Some Airmen even hunt down Mother Nature's fiercest storms — hurricanes.

Hurricane hunting is a mission assigned to a select group of Reserve Airmen. The men and women of the 53rd Weather Reconnaissance Squadron, assigned to the 403rd Wing at Keesler Air Force Base, Miss., fly Hercules WC-130J aircraft, affectionately known as "Hurricane Hunters," into the heart of storms. Their mission is to collect storm data and send it to National Hurricane Center forecasters, who plug the information into computer models and interpret the results in an effort to provide increasingly more accurate forecasts.

"We help the hurricane center improve their forecasting models," said Lt. Col. Val Hendry, who has been an aerial reconnaissance weather officer, or ARWO, for 23 years. "By 'initializing' them, we report where and how strong the storm is right now, and that enables the computer models to make a more accurate prediction of what the storm will do in the future."

According to AFRC officials, one hurricane mission can pay for itself when costs associated with coastal evacuations are taken into account. For example, officials estimate that it costs about \$1 million per mile of coastline to evacuate the residents of highly populated areas.

—Airman staff



HUNTING HURRICANES

Pilot Lt. Col. Mark Carter admires a

photo by MAJ. CHAD E. GIBSON

Sunset after nine hours of flying into a hurricane. The Air Force
Reserve "Hurricane Hunters" of the 403rd Wing at Keesler Air

Force Base, Miss., fly 24-hours-a-day, collecting data inside the heart of Mother Nature's
fury. The data collected by the Hurricane Hunters improve the National Hurricane Center
forecast by more than 30 percent.

STRESS RELIEF Staff Sgt. Eric Began, a vehicle operator for the photo by STAFF SGT. SHAWN WEISMILLER Paktya Provincial Reconstruction Team, relaxes at Forward Operating Base Gardez, Afghanistan, by playing a Beethoven composition on the piano. Sergeant Began taught himself how to play the keyboard as a way to pass time and uses it to relax during deployment.







TRAINING WARRIORS Traversing an algae-filled water feaphoto by MICHAEL TOLZMAN ture on the obstacle course at Lackland Air Force Base, Texas, basic military trainees under the watchful eye of a military training instructor, attempt to cross on a cable and rope bridge. These trainees are on their way to becoming warrior Airmen.



The sample of the H1N1 influenza virus. Specimens a mucus sample for the H1N1 influenza virus. Specimens

to collect a mucus sample for the H1N1 influenza virus. Specimens are used for a culture sample and rapid testing. Sergeant Gills is assigned to the 20th Medical Operations Squadron at Shaw Air Force Base, S.C.





© CAP SUPPORT Civil Air Patrol Lt. Col. Wayne Schulz conducts preflight

photo by STAFF SGT. JACOB BAILEY | checks on a C-182 Cessna before taking off in support of Amalgam Dart 2009. Amalgam Dart is a field test of the Department of Defense's ability to rapidly deploy an integrated air defense system.

LANDING THE GIANT A pair of B-52 Stratophoto by STAFF SGT. TIA WILSON fortresses come to a halt on the Eielson AFB, Alaska, flightline as another prepares for landing during Northern Edge 2009, Alaska's largest military training exercise involving components from the Air Force, Army, Marine Corps and Navy.



APPLIED TRAINING An Explosive Ordnance Disphoto by SENIOR AIRMAN COURTNEY RICHARDSON posal Airman measures simulated unexploded ordnance with a caliper

for identification during training at an air base in Southwest Asia. Airmen train annualy to recognize and respond to UXOs.



RETURNING HOME Airmen from the 375th Airlift

Photo by AIRMAN 1ST CLASS WESLEY FARNSWORTH Wing are transported in a C-17

Globemaster III during their return

flight home to Scott AFB, III. The Airmen participated in a week-long training exercise preparing for an operational readiness inspection.

PREDICTING WEATHER A Delta IV rocket lifts off from Cape

| Canaveral Air Station, Fla., equipped with a Geostationary Operational
| Environmental Satellite aboard. This type of satellite is used to help fore| casters predict weather and climate change.



WALET PARKING Airmen from the 621st Contingency Response Wing,

photo by STAFF SGT. NICHOLAS PHELPS Joint Base McGuire-Dix-Lakehurst, N.J., load two Army Humvees
onto a C-17 Globemaster III during a noncombatant evacuation

exercise at Mackall Army Airfield, N.C. During the exercise, CRW Airmen onloaded and offloaded more than 1,500 passengers and 75 short tons of cargo and equipment.





NEW PERSPECTIVE A pararescueman from the 320th Special Tacphoto by TECH. SGT. AARON CRAM tics Squadron at Kadena Air Base, Japan, observes a Paskau member of the Royal Malaysian Air Force who is conducting a search
pattern during an underwater search and recovery course. The Paskau is the special operations branch of the Royal Malaysian Air Force.

INTENSE TRAINING Firefighters at Offutt Air Force Base, Neb., battle the flames on an aircraft fire trainer during an exercise. Firefighters from active-duty, Air Guard and Reserve units participated in the disaster-training exercise.







SUPPLIES A pallet containing humanitarian relief supplies destined for Pakistan photo by STAFF SGT. SHAWN WEISMILLER is prepared for loading into the cargo bay of a C-17 Globemaster III, at an air base in Southwest Asia.

Pate fills ACADEMY PHYSICIST DEVELOPS SATELLITE IMAGING TECHNOLOGY

STORY BY STAFF SGT. MATTHEW BATES 🐧 PHOTOS BY STAFF SGT. DESIREE PALACIOS

rom childhood, most remember singing the song, "Twinkle, twinkle, little star," at one time or another.

There's just one problem with this little ditty.

"Stars don't twinkle," said Dr. Geoff Andersen, a physicist at the U.S. Air Force Academy. "This is just the effect of atmospheric turbulence on our ability to see into space."

This turbulence not only has led to the creation of catchy tune, but it makes it harder for ground-based telescopes to see into space. It also makes it harder for these telescopes to see satellites orbiting high above the earth.

So, Dr. Andersen, who works in the Academy's Laser and Optics Research Center, is developing a new capability that will allow satellites to be seen and see clearer.

Dr. Andersen developed and holds the patent for the process, which is called holographic adaptive optics. It uses sensors and lenses that can correct for disturbances in the atmosphere, making objects in space appear clearer.



The process uses adaptive technology to compensate for this turbulence.

"Think of it like wearing a pair of glasses," Dr. Andersen said. "When someone has poor eyesight, the prescription compensates for this and makes his or her eyesight better. This process is similar. It uses adaptive optics so telescopes can see into space better."

This is important to the Air Force because it will allow operators to better see satellites. For instance, if a satellite stops communicating with people on the ground, they can view it through a telescope to see if they can determine what caused it to go off the grid.

"Naturally, the clearer you can see the satellite, the easier it will be to diagnose the problem," Dr. Andersen said.

Air Force officials have been using various forms of technology to view satellites for several decades, but the equipment used to perform this is expensive, computer intensive and large.

"The computer itself is as large as a fridge," Dr. Andersen said. The physicist's new system uses holograms and is condensed into a device the size of a standard DVD player.

This makes it cheaper and opens the door to new possibilities.

"We could place one of these devices on a satellite and then the satellite would be able to see down to earth with a crystal image," Dr. Andersen said.

Devices also could be placed on unmanned aircraft, allowing them to produce a clearer image for combatant commanders. UAs are perfect candidates for this technology due to their type and height of flight, Dr. Andersen said.

"UAs produce their own turbulence when flying and they tend to fly in the general area where atmospheric turbulence is high," he said. "This new technology would eliminate these problems and allow the UA to produce a high-quality, sharp image."

The adaptive optics technology goes beyond having only military applications. It also has uses within the medical arena, especially that of laser eye surgery.

"This technology will make eye surgery more precise and specialized," Dr. Andersen said.



Air Force Cadet Will Holmes conducts holographic adaptics optics research with Army Cadet Richard Carter and Geoffrey Andersen at the U.S. Air Force Academy, Colorado Springs, Colo.

Capabilities aside, Dr. Andersen said he is proud to be instrumental in the creation of this holographic technology. And being on the cutting edge of technology is nothing new to the physicist. Since beginning his 13-year tenure at the Academy he's earned a total of four patents.

But he doesn't look for new ideas and technologies just to add to his resume. He does it to help the students he teaches, cadets who will head out into the Air Force and take what they learn with them.

"They get hands on to help find solutions using research," he said. The students are happy to help, knowing that the work they are doing today could possibly shape the imagery technology of tomorrow.

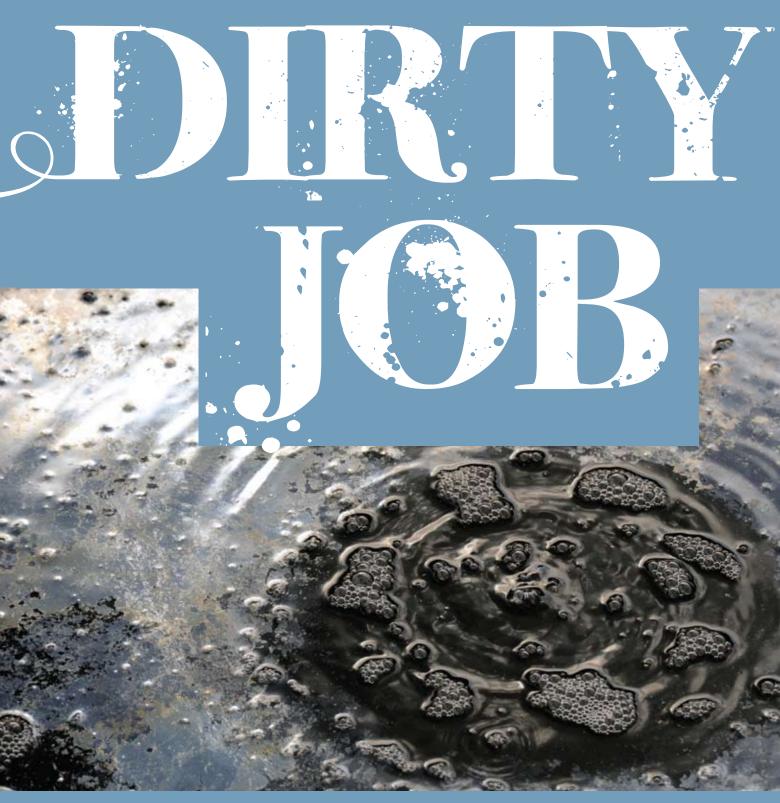
"It makes it really worth it knowing there's a real-world application for what we're doing here in the laboratory," said Cadet Will Holmes, a senior at the Academy. "And it's great getting to work with Dr. Andersen."

Stars may not twinkle, twinkle, but they sure will be easier to see.



Air Force Cadet Will Holmes conducts holographic adaptics optics research while Dr. Geoffrey Andersen discusses optics with Army Cadet Richard Carter. Cadet Carter is a junior in an exchange unit from West Point and Cadet Holmes is a senior at the academy.





AIR FORCE REAL PROPERTY AGENCY GETS DIRTY, IN ORDER TO CLEAN UP

STORY AND PHOTOS BY TECH. SGT. MATTHEW MCGOVERN

igging a hole is not the complicated part.

Sorting and removing potentially contaminated soil and breaking down harmful chemicals by using living microbes is where it gets interesting.

At former Kelly Air Force Base in San Antonio, the site of a former aircraft metal plating shop used during World War II, these microbes thrive on a "cocktail" of vegetable oil and cottonseed that is placed regularly into a four-story deep hole.

The microbes feeding on this sludge, such as bacteria, break down harmful chemicals into harmless gases and water. Underground barriers called slurry walls are constructed around the dig site at depths of 100 feet to stop ground water flow and to hold contaminated groundwater.

The soil will be removed by contactors with environmental consulting firm Tetra Tech, and tested then separated. The "clean" soil will eventually go back in the hole and the "dirty" soil will be taken to a contained land fill where it will pose no threat to human health.

The Air Force Real Property Agency and the Air Force Center for Engineering and the Environment set a joint goal to have all sites in "Remedy in Place" or "Response Complete" status by 2014 to address environmental contamination caused at Base Realigment and Closure bases before they closed.

"It was common practice in the past to dispose of things down the sewers and on the ground, the harmful effects weren't known at the time," said Paul Carroll, the BRAC environmental coordinator. "It wasn't just the Air Force, it was industry wide.

"The important part of the AFRPA goal is to clean up these old bases," he said.

This process requires extensive coordination between the Air Force, EPA, state regulatory agencies and local communities to ensure successful cleanup that clears the way for property transfer.

"AFCEE, with its suite of contracts and contractors, provides a broad range of environmental remediation capabilities," said Dennis Lundquist, AFCEE's acting Chief of Environmental Executive

"Our toolbox allows us to provide the latest and most innovative



At the direction of Air Force Real Property Agency officials, contractors remove potentially contaminated soil at the site of a former aircraft metal plating shop used during World War II, at former Kelly AFB in San Antonio.



Matthew Murray, a geologist, checks the flow of water that increases conductivity to heat the area around a soil vapor extraction site at former Kelly Air Force Base, San Antonio.

solutions in remedial technologies," he said.

Before the goal can be reached and before cleanup begins AFRPA officials do what they call a characterization of each site.

First, environmental scientists evaluate the area and determine the most efficient way to clean up the site. They take water and soil samples to reveal what type of pollutants are in the soil.

"When AFRPA did a site characterization of this site, they found that a plume was heading off base. A slurry wall was constructed around the dig site to prevent the plume from continuing off base and this (dig project) actually takes care of the contamination on the base," said Robert Moore, the director of the Air Force Real Property Agency.

"When they closed (Kelly AFB) the community was concerned," Mr. Moore said. "The community wanted to know if the Air Force would walk away from the environmental issues or if they would follow through and clean up.

"We are committed to the economic development of the local

community and the environmental cleanup of every installation; every site across the Air Force, not just at Kelly AFB," he said.

The director said the site will be used as a parking area for the largest administration facility at the former base.

"AFRPA and AFCEE, along with nine other tenant agencies will be housed here and this project site will be where I will actually park," Mr. Moore said.

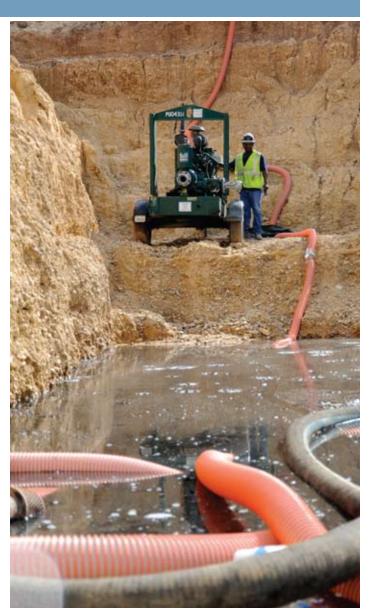
Though the site is on its way to becoming a major accomplishment, the director said AFRPA is not done with Kelly AFB when the site is complete.

"We have more than \$40 million dollars that we are going to invest in Kelly AFB to complete it environmentally," Mr. Moore said.

Among the 26 sites currently under remediation at the base is another metal plating shop area roughly a mile away from the excavation site. There, an innovative process called electrical resistive heating is being used to clean up that soil. This process cleans polluted soil by heating up the ground and extracting chemical vapors with tubing, then disposing of them with a treatment system at the surface.

"We are committed to the economic development of the local community and the environmental cleanup of every installation; every site across the Air Force, not just at Kelly Air Force Base"

– Robert Moore



A Contractor extracts sludge from a mixture of vegetable oil and cottonseed used to break down harmful chemicals into harmless gases and water at Kelly USA, San Antonio.



Robert Moore, the director of the Air Force Real Property Agency, explains the soil removal process at a former metal plating shop dig site at the city-owned Kelly USA in San Antonio.

Mr. Carroll said that 75 percent of the excavation site has reached its remediation goals and anticipates completion by the end of the summer.

Mr. Carroll also spoke on a new innovative cleanup process that involves hybrid poplar trees used around a landfill at former Chanute AFB, Ill.

Also managed by AFRPA, the Chanute project uses the trees to absorb liquid that has been in contact with landfill waste. The trees act as a barrier to prevent water migration and filter out contaminents.

"This is the first time we've used this process at a closure location," said Stephen TerMaath, the AFRPA's acting chief of environmental program management.

"One nice thing when you use poplar trees is that you do not have to rely on technology, like a pump that can break. It's always there and is effective," Mr. TerMaath said.

AFRPA officials expect the use of these trees will increase ecological habitat, reduce energy consumption and reduce the cost of maintenance.

These innovations have helped AFRPA officials transfer 86 percent of BRAC property, that's more than 75,000 acres of land, to the community.

"We try to bridge that gap where a community has been hit by an impact because of a base closure," Mr. TerMaath said. "We try to transfer the property to somebody that's going to redevelop it. That re-development will provide jobs and resources to the community."

"The transfer of land creates jobs in the community, and nation-wide," TerMaath said. "Approximately 71,000 people are employed at those communities. This is 31,000 more than during the operation of the bases."

At Kelly USA, an industrial area that was once part of Kelly AFB, there are more than 5,000 jobs now that weren't there before the base closed. And upon completion of the excavation site, more than 2,700 folks will move into the administration facility and park their vehicles where a four-story hole used to be.

Digging the hole is the not the complicated part. Cleaning the site with the use of innovative processes, before moving the community back in, is where the complexity lies.

The outcome is what makes the money spent on projects such as these worth it," Mr. Moore said.

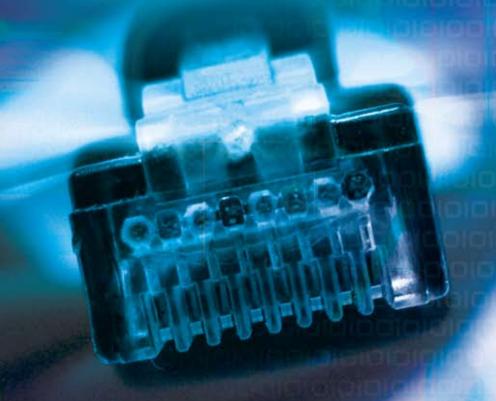
"It (the outcome) justifies the \$2.8 billion we spent environmentally in AFRPA for base closure and realignment. We still have \$800 million to spend," Mr. Moore said.

"We are in this and, as the Air Force chief of staff says, "'We're all in,'" he said.

CYBER VIGILIANCE

EACH TIME YOU USE A NETWORKED DEVICE, YOU ARE ON PATROL FOR OUR NATION.

THE FIRST LINE OF DEFENSE, STARTS WITH YOU.



KEEPING THE AIR FORCE SAFE FROM CUBER TERRORISTS.

GOOD, CLEAN SCIENCE

TOP SCIENTIST DIRECTS RESEARCH TO SAVE MONEY AND THE ENVIRONMENT

BY STAFF SGT. J. PAUL CROXON

hinking of the Air Staff conjures up the image of generals discussing the future Air Force weapons systems and their employment. That image is partially correct. The staff is made up of generals and they do plan for the future of American airpower. However, making the assumption the members of the Air Staff are strictly military officers overlooks important civilian members. Most civilian Air Staff members have backgrounds in the military; one has a background in good, clean science.

That seat is currently held by Dr. Werner Dahm, the Chief Scientist of the Air Force. To serve in this role, he has taken temporary leave from his position as a Professor of Aerospace Engineering and head of the Laboratory for Turbulence and Combustion at the University of Michigan. Though the Air Force programs he helps oversee range widely in topic and application, some of the most far-reaching will impact the way energy is used in the Air Force.

Whether driving a car or heating buildings, the increasing cost of energy affects nearly everyone. The Air Force accounts for nearly 60 percent of the Department of Defense's annual fuel use, so developing technologies to use fuel in the most efficient way is crucial to the mission.

Programs to increase energy efficiency range from installationlevel initiatives, such as green energy procurement, the redesign of current weapon systems, the development of future weapons systems, and even changes to current operations.

Since more than 80 percent of Air Force fuel is consumed by aviation operations, finding smarter ways to design, build, and fly aircraft translates into real savings. Yet, newer aircraft are already much more efficient that their predecessors. It's like trying to squeeze better mileage out of today's highly efficient cars. It can be done but it requires extensive research, radical changes.

Dr. Dahm said there are three ways of increasing fuel efficiency in aircraft: more efficient engines, a more aerodynamic shape, and reducing airframe weight. The Air Force is researching all three of these.

Mobility aircraft account for the largest overall fuel usage, nearly 55 percent of the total Air Force fuel bill. Making these large aircraft more efficient will generate dramatic savings. One of the most obvious ways to improve them is to use more efficient engines.

Dr. Dahm said Air Force Research Laboratory scientists are studying ways to increase the performance of engines through the Versatile Affordable Advanced Turbine Engines, or VAATE, program. "The VAATE program is made up of many smaller projects," Dr. Dahm said. "The savings from them add up to large increases in fuel efficiency that can be used both in existing and future aircraft systems."

The largest of these is called Adaptive Versatile Engine Technologies, or ADVENT. This is a radical change in the way gas turbine engines operate, creating the first constant airflow engine. The technologies being developed in ADVENT and other parts of the VAATE program will begin appearing in improvements to fielded engines and new engines in about 10 years or so," he said.







Because science is so crucial to the Air Force, the service created the position of Chief Scientist in 1950. Dr. Werner Dahm is the current chief scientist and is the primary science advisor to senior Air Force leaders. With a background in aeronautical engineering, he also directs which programs the \$2 billion budget is spent on.





Fuel savings aren't limited to redesigning engines either. Additional and dramatic savings can be found by redesigning the way aircraft are shaped.

"For example, by adding winglets to aircraft wingtips we can effectively increase the wing span, and thereby increase the lift-to-drag ratio," said Dr. Dahm. "We can go even further and change the shape of the entire aircraft from the traditional tube-and-wing design to a blended wing-body design, a shape closer to that of the B-2 Spirit that gives greatly decreased drag and increased fuel efficiency."

Dr. Dahm added that it's been known for some time that blended wing shapes are more efficient. The commercial aircraft manufacturers have studied such designs for both passenger and transport aircraft, and the benefits in fuel savings are dramatic. "It is as much a matter of overcoming perceptions of what an airplane 'should' look like," he said.

In the Air Force, such radical designs will likely first appear in transport and tanker aircraft, where the fuel saving are greatest. According to Dr. Dahm, the know-how exists today for building a large-scale demonstrator aircraft to assess practical implementation and operational benefits of the blended wing concept. "Once we decide that the development costs are justified by the fuel savings over its service life, we could begin seeing this new type of aircraft in about a decade," he said.

Should that implementation take place, it will include new materials that are not only lighter, but stronger as well. The resulting



Much of the scientific research Dr. Dahm oversees as the Air Force chief scientist has environmental implications. Changing the way aircraft are flown in formation and research into new engines will have dramatic impacts on the Air Force's fuel consumption.

weight savings translate into even further fuel savings.

Such planes may still be years from production, but the places they will operate from are also becoming more energy efficient. According to Dr. Dahm, many Air Force installations are using technology to offset or replace their dependence on fossil fuel.

"Green technology can't be implemented in the same way at every location," Dr. Dahm said. "Wind farms are currently providing electricity at Fairchild [Air Force Base, Wash.], but they may not be a good choice for bases where they would produce radar interference."

Dr. Dahm said geothermal energy is being investigated at Minot AFB, N.D.; solar arrays have been implemented at Nellis AFB, Nev.; gas produced from a local landfill heats hangars at Tinker AFB, Okla.; and at Hickam AFB, Hawaii, solar energy is used to produce hydrogen, which then fuels maintenance vehicles. They're just a few examples among many uses of alternative energy already in the works across the Air Force.

Together with other members of the Air Staff, Dr. Dahm, as chief scientist, helps decide which technologies the Air Force should invest its more than \$2 billion annual research budget in.

"It's important to balance current needs and future requirements" said Dr. Dahm. Advising leaders on technology opportunities and their operational impacts is a major aspect of the chief scientist's job.

Recently, Dr. Dahm and members of the Air Force Scientific Advisory Board showed striking impacts on fuel economy that can be obtained by flying aircraft in formation to take advantage of the vortex produced from each wing tip through flight.

He said by having as few as two aircraft fly in formation, a 14 percent improvement in fuel efficiency could be realized. What's even more impressive is that it isn't just the trailing aircraft that reaps the benefits, both aircraft benefit.

"If the trailing aircraft can fly in the 'sweet spot' produced from the lead plane it decreases the drag on both," he said. "The main challenge is that sweet spot is constantly shifting, so pilot fatigue increases if they have to stay in that spot manually. Technology can solve that by relatively simple software that automatically uses trim adjustments find the sweet spot and stay in it."

Dr. Dahm said the aircraft can be separated by a considerable distance and still see most of the benefit and that even dissimilar aircraft benefit from flying in formation.

"The benefit small aircraft see when they fly in formation with large aircraft can be so large that the fuel savings can actually equal the fuel those small aircraft would need flying solo."

Having a full-time Chief Scientist at the Air Staff level is unique to the Air Force, and reflects the crucial role that technology plays in helping the Air Force achieve its mission. The way the position is filled is also unique.

"Chief scientists temporarily set aside their careers in academia or industry to serve full-time in the Pentagon," Dr. Dahm said. "It's been that way ever since Theodore von Karman served as the science advisor to Gen Hap Arnold, when the Air Force first became a separate service. Having that person be a scientist who comes from outside is essential to providing a fresh perspective and independent advice on research to the highest levels of the Air Force. The job is demanding, but it's a real honor to be given the opportunity to serve the Air Force and the nation in this way."

The future of the Air Force and its ability to adapt to rapidly changing energy needs will depend greatly on the direction given by the Chief Scientist. The promise is cheaper, greener and more efficient aircraft and operations, all resulting from good, clean science.





STORY BY STAFF SGT. J. PAUL CROXON 😂 PHOTOS BY STAFF SGT. DESIREE N. PALACIOS

Jet fuel is strange. It needs to have seemingly contradictory properties to make it useful. It can't freeze. It can't have a low flashpoint or easily vaporize. Yet, it must have a tremendous amount of energy for its volume and lubricate and seal fuel lines in aircraft. In the more than 30 years the Air Force has been studying its primary aircraft fuel, known as JP-8, scientists are still learning new things.

While Air Force scientists learn about the soup of various hydrocarbons known as IP-8, the future is about new alternative fuels that can be tailored at the chemical level to fit a particular need. The fuel industry is already using new techniques applied to old processes to produce a drop-in replacement for JP-8 and they are making it out of everything from coal to weeds. They just need a market.

CERTIFICATION NOT PRODUCTION

The Air Force isn't in the business of producing fuels. That's the job for industry which has already produced dozens of synthetic fuels. However, the Air Force must certify its aircraft to be able to use a particular fuel, usually a 50/50 blend with JP-8. The potential list of fuels is long and varied and caused the Alternative Fuels Certification Office to look at certification in a new way with the help of Air Force Research Laboratory.

"We've received 83 fuel samples from industry so far this year," said 1st Lt. Ben Schulze, a fuels research chemist at Fuels and Energy Branch at AFRL's Propulsion Directorate. "The samples vary from half a liter to 20,000 gallons." He added that some of the samples will undergo further testing and may be used in fullscale fuel simulator systems.



The Air Force Research
Laboratory's fuels research
is done on more than 80
samples of fuel including
current Air Force and industry
fuels. They are all stored in an
on-site fuel farm in quantities
ranging from a few ounces to
thousands of gallons.



It's impractical to certify each and every fuel that comes in. Scientists use state-of-the-art techniques, many of which have never been applied to fuel, in order to try to predict whether a fuel is a good candidate for use in Air Force weapons systems.

A better way of certifying these new fuels is to certify a manufacturing process instead of individual products. While there are potentially many ways of making synthetic fuels, the most understood is the Fischer-Tropsch, or FT, process and its variations.

DR. FISCHER AND DR. TROPSCH

The United States has one of the world's largest coal reserves with the potential for large quantities of domestically-produced jet fuel. The technology for converting coal, or potentially any organic source, into fuel was pioneered in the 1920s by German scientists Franz Fischer and Hans Tropsch. Since then it has been applied on a large scale by a handful of companies.

There are various ways of using the FT process to produce a usable fuel. A process known as gasification converts coal and biomass into syngas, a mixture of hydrogen and carbon monoxide. The syngas is then converted into longer and longer hydrocarbon chains using the FT process. These hydrocarbons are basically combinations of carbon and hydrogen atoms. The process can be adjusted to produce chains of a particular length that correspond to a particular

fuel. Smaller chains are appropriate for gasoline, longer chains for diesel or jet fuel, and the longest chains as waxes.

The fuel produced is cleaner and simpler than JP-8. It contains almost no sulfur, none of the complex chemicals known as aromatics and is almost completely clear. As expected, this fuel is very clean.

"[When using] 100 percent FT fuel, we're seeing a reduction in particulate emissions of up to 97 percent in the small engines we're using here," said Edwin Corporan, a professional engineer with the fuels and energy branch. "At a higher power condition it's still a 50 or 60 percent reduction."

Though the fuel is cleaner, the more simplified nature of it has some drawbacks. According to 1st. Lt. Ben Schulze, a research chemist with the Fuels and Energy Branch, the lack of aromatics affects the fuel's ability to seal some systems in Air Force aircraft since these chemicals cause rubber seals to swell. Since aircraft are designed to use the additional properties of JP-8 to seal systems, this lack of aromatics must be overcome through blending of the fuel with JP-8.

"We ran a 100 percent FT fuel test on a NASA DC-8 and let it sit overnight. When we came back the next morning fuel was leaking out of the plane," said Corporan. "After we drained the aircraft and refueled it with a 50/50 blend of JP-8 and FT fuel it sealed up again."

An Air Force biologist inoculates bacteria onto a Petri dish. The bacteria are known to consume current aviation fuels and researchers are investigating whether they will have similar appetites for synthetic fuels.

TESTING THE UNKNOWN

Fischer-Tropsch fuels were the first to be researched closely due to their similarity to JP-8 and the long history of the FT process. AFRL scientists use a variety of techniques to test these fuels trying to get a picture of their characteristic long before they are tested in aircraft.

One test commonly used is the gas chromatograph which analyzes a sample of gas and identifies specific compounds by their molecular weight. The compounds are then plotted and each peak should be a hydrocarbon chain with a specific length. This picture is then compared to the GC image of JP-8 so scientists are able to see potential dissimilarities. However, like a city skyline, more disparities can be a hiding in the shadow of a larger compound.

"The GC is plotted against time," said Lieutenant Schulze, adding that the technique doesn't differentiate between compounds that are plotted at the same time so





Mark Laber, left, a University of Dayton research partner. examines the expansion of aircraft seals using synthetic fuels. One of the uses of current aviation fuel is to swell seals found throughout the aircraft

Air Force contractors work to develop start-up procedures for a system used to produce synthetic fuels. The new piece of equipment will allow researchers to create small quantities of synthetic fuels with specific properties.

some compounds don't show up.

Lieutenant Schulze has pioneered the use of nuclear magnetic resonance spectroscopy to further identify and analyze irregularities in the overall GC picture. Instead of identifying compounds by mass, this technique is able to look at the bonds within molecules in a substance and identify the shape and nature of the molecule based on this information. Yet it isn't the only novel technique to be applied to the fuels research.

For 1st Lt. Daniel Pike, a research biologist with fuels and energy branch, fuels are an environment where bacteria, molds and yeast thrive. These organisms primarily inhabit the natural transition zone where water and fuel meet producing a sort of bio-

"The bio-film is made up of cellular waste, dead and living micro-organisms, and other substances," he said. "By following proper maintenance protocols and technical orders, maintenance personnel are able to keep the bio-films from becoming a potentially bigger problem. We're trying to culture bacteria found in JP-8 to see if they react differently to FT fuel."

Progress is being made by looking at the FT fuels from every angle and through collaboration between different sciences. As Lieutenant Schulze put it, "It's at the intersection of specialties that break-throughs are made."

ROAD TO CERTIFICATION

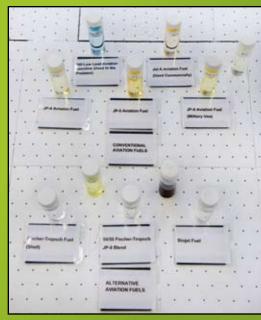
Many hurdles must be overcome before the Air Force begins flying operational missions on synthetic fuels. The first hurdle is to take the research data compiled by AFRL and use it to certify the fuel for a particular airframe. It takes coordination with multiple agencies including the Air Force Petroleum Agency and the program managers for each airframe. Currently there are five aircraft certified to use 50/50 blends of FT and IP-8. The entire fleet is scheduled to be certified by fiscal 2011, but not every airframe will need to undergo the same sets of rigorous tests. Through lessons learned and partnerships with industry, which is pushing for civilian certification of synthetic fuel blends, the certification process is able to be shortened.

Air Force scientists are leading the way for an Air Force-wide use of synthetic fuels. The next step for AFRL and other agencies is to certify other synthetic fuel production processes starting with hydrotreated renewable jet fuel, which can be made from various feed stocks including waste animal fat from food companies, or other non-edible bio-oils.

Because of the work done by Air Force scientists, there may be a day in the near future when an Air Force pilot receives fuel from a tanker on the other side of the world and the fuel he receives may finally be domestically produced and one where the properties were designed in a lab instead of existing by chance.



Samuel Tanner, an Air Force supply technician contractor, connects fuel lines used to supply specific laboratories with fuel samples from the fuel farm.



Air Force Research Laboratory scientists analyze and test various current and synthetic fuel samples. As shown here.

FUELS RESEARCH BIOLOGIST

lst Lt. Daniel D. Pike



I have one of the best jobs the Air Force. I am surrounded by people and work leading-edge technologies on a daily basis. At the same time, I have the privilege of helping the Air Force shape modern science in such a way that it benefits our warfighters.

HOME UNIT/BASE:
Air Force Research Laboratory

Propulsion Directorate

Wright-Patterson Air Force Base, Ohio

HOMETOWN:

Rochester, NY

ENTERED AIR FORCE: July 6, 2006

PRIMARY AFSC:

61SC

Million dollar IDE/

uring times of budget cuts and fiscal restraint, all good ideas should be examined for possible implementation into day-to-day operations throughout the Air Force. The IDEA program, or Innovative Development through Employee Awareness, is a way for the total force to recognize better ways of doing the mission at their level. Each year IDEAs are submitted that save the Air Force money. Some of them save the Air Force millions of dollars. Below are the 2009 submissions that saved the Air Force more than \$1 million each year per idea.

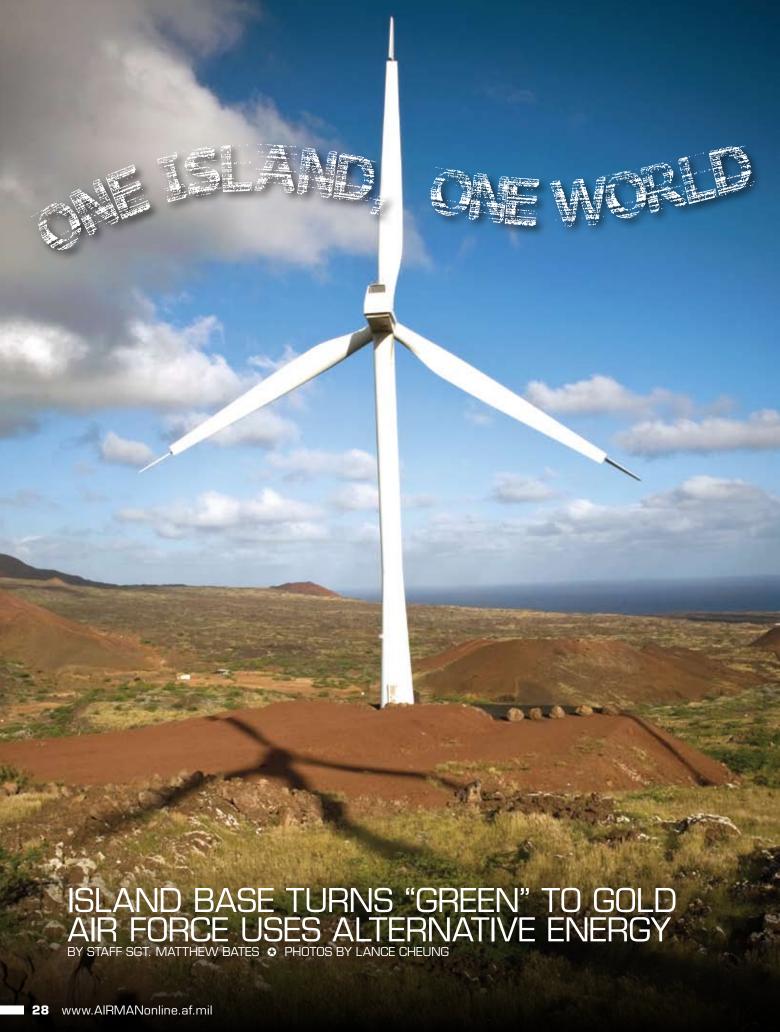
Airman staff

- **LANCER TESTING = \$13,011,220** Kenneth Harris recommended that the 402nd Software Maintenance Group migrate legacy B-1 Lancer test program sets at the radar/electronic warfare station to another legacy tester allowing the 402 SMG to focus on the newer advanced digital test station. Mr. Harris is from Ellsworth AFB, S.D.
- **UPDATING C-5 UPGRADES = \$8.753.876** Jay Ostler, Robins AFB, Ga., proposed the removal of the C-5 Galaxy elevator variable feel unit from the Reliability Enhancement and Re-engining Program. By updating specifications and redesigning and manufacturing an improved legacy EVFU, Mr. Ostler eliminated the need to purchase a new costly EVFU.
- **VISUAL ENGINE INSPECTIONS = \$2,458,276** Christopher Moman, Randall Nutt and Don Corona, Tinker AFB, Okla., suggested performing a visual inspection of Area E of the F-110 engine. If scratches, scores, corrosion, erosion, or pitting was noticed during the inspection, a leak test would be performed. If the leak test passed, the visual inspection is waived. This process decreased the condemnation rate from 98 percent to 12 percent.
- AIR PLENUM REPAIR = \$2,189,260 Robert Foster, George Crawford and Leroy Phillips, Robins AFB, Ga., developed a procedure to repair air plenum, a space used to move air in building, using a 3M ® Scotch-Weld Epoxy Adhesive.
- MICROPROCESSOR DESIGN = \$1,432,000 Mark Lynch, Hill AFB, Utah, designed a microprocessor based on a remote power controller that allows automatic site shutdown in the event of a fire; and that a maintenance technician would remotely restart individual radar subsystems. The current process did not allow for these actions to occur.

REFURBISH SHIPPING CONTAINERS = \$1,340,000 Capt. Blair Byrem, Tech. Sgt. Gene Sing, Tech. Sgt.

Jeramie Wade and Staff Sgt. Books Hartley, Eglin AFB, Fla., recommended securing 93 ALQ-131 shipping caskets from Defense Reutilization and Marketing Office and refurbishing them rather than purchasing new shipping caskets to transport ALQ-188 pods.

- **REFUELING ADJUSTMENT = \$1,333,410** Lt. Col. John Cinnamon, Laughlin AFB, Texas, suggested fueling the T-1 Jayhawk to the mission required level rather than the current process. The new procedure reduced the average T-1 fuel on-load at an off-station location from 300 gallons to 240 gallons.
- **REUSE CONTAMINATED SOIL = \$1,153,616** Mahalingam Ravichandran, Lackland AFB, Texas, suggested the excavation of all contaminated soil and reuse it at the small arms firing ranges at Lackland Training Annex rather than hauling the contaminated soil for off-base disposal.
- OFF-THE-SHELF TELEPHONE = \$1,139,000 Master Sgt. John Owen, Offutt AFB, Neb., proposed purchasing commercial off-the-shelf replacement wall mounted telephones and locally modify the units for E-4 aircraft application. The current system was identified as obsolete. The cost to replace the current phones with specialized phones thru E-4 Prime Sole Integrator would have cost \$1,250,000.
- **REPACKAGING ANTENNAS = \$1,091,776** Robert Minard, Hill AFB, Utah, recommended changing the packaging procedures of APG-66/68 antennas used on F-16 Fighting Falcons. By changing the packaging procedures, technicians eliminated damage from mishandling and shipping expenses.





ind energy is nothing new. It's been around in one form or another for centuries, and since early recorded history, people have attempted to harness this natural form of energy.

All around the world, wind is used to sail ships, and windmills are used to pump water and even grind

Today though, people are looking to wind energy to produce electrical power. Wind mills have been replaced by wind turbines, and these sleek, streamlined structures have become icons of the renewable energy movement, a movement that is growing. According to Department of Energy officials, wind turbines accounted for 42 percent of all new electricity generation added to the U.S. power grid last year and that electricity makes up three percent of the nation's total energy grid.

But, Airmen and civilians at one remote Air Force base know all about the benefits of wind energy. They've already been using this renewable resource for more than a decade.

WINDS OF CHANGE

The remote base is located on Ascension Island, a British-owned island located in the South Atlantic Ocean. Called Ascension Auxiliary Airfield, the small base serves as a satellite tracking station for Air Force Space Command's 45th Space Wing, and is the most southerly tracking facility for space launches from Cape Canaveral, Fla. When the space shuttle launches this is also the last emergency airfield before it achieves orbit.

In 1996, AFSPC engineers installed four 225-kilowatt wind turbines on the island to supplement the station's electrical power supplied by fuel-driven generators. The idea to build a wind farm was actively pursued because of the island's remote location, its steady winds and the high cost of fuel oil shipments.

"We're in an isolated location here, so we're pretty self-sufficient when it comes to power generation," said Maj. Jay Block,

commander of the 45th Space Wing's Detachment 2 on the island.

So, the wind turbines were built and became the first operational wind farm in use, not only in the Air Force, but in the entire Department of Defense.

"Once the turbines were up and running, no one really knew what to expect," said Damien Cuello, who works at the airfield's power plant.

But, the results were almost immediate.

During the first four months of operation, the four three-blade turbines produced more than one million kilowatt hours of electricity. And, with an average wind speed on the island of 16 to 17 miles per hour, the wind generators produce an estimated 2.5 million kilowatt hours of energy each year. Fuel oil consumption also is down by nearly 300,000 gallons for an annual savings of \$350,000.

"In fact, the project, which cost around \$3 million, has already paid for itself," said Jim Henning, the base's utilities supervisor.

The wind farm was such a success that it led to a number of other projects, including the construction of two additional 900-kilowatt turbines on the island, effectively tripling the amount of wind energy the farm is capable of producing.

"The 2.7 megawatt combined output of all the turbines could easily constitute 40 percent of the base's total energy production, an unprecedented level of use," said Henning.

However, the two large turbines had to be taken off the grid because the power fluctuations they were causing were too much for the generators to handle. But, with advancements in technology, the base's power station expects to have the turbines back in business soon.

"We expect to have the large turbines back on the grid within a couple years," said Henning.

The wind farm's power output is used to help power facilities for more than 400 people on the Air Force installation and for the runway and tarmac shared with the Royal Air Force.



Damien Cuello Jr. performs an operational check of a rotating 900 kilowatt wind turbine brake disk at the 45th Operations Group Detachment 2, Ascension Auxiliary Airfield. The power house mechanical associate stands at the controls as one of the three approximately 80-foot blades passes in the background.



George Benjamin takes a sample to collect organisms for examination from wastewater that is aerating to invigorate the activity of the "bugs" at a treatment plant at Ascension Auxiliary Airfield.

HOW TURBINES WORK

Wind is actually a form of solar energy. Winds are caused by the uneven heating of the atmosphere by the sun, by the irregularities of the earth's surface and by rotation of the earth. Wind flow patterns are modified by the earth's terrain, bodies of water and vegetation.

The term wind energy, or wind power, describes the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.

A wind turbine is the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

HYBRIDS ARE NOT JUST CARS

In general wind turbines are dependent on wind – they could simply stop. Diesel engines have always been a part of the power production process at the airfield. By combining the two power sources, the system works in much the same way a hybrid car produces power.

"The diesel generated power is needed to provide stability to the system and pick up the load when wind velocity changes or the sun goes behind clouds," explained Henning. "The design of our wind turbines only produce amps, which is only part of the power equation. These turbines cannot produce or control voltage or frequency, they must be on an energized line to produce the amps they do."

Running on JP-8, the same fuel Air Force jets use, two 1,900-kilowatt and three smaller diesel generators makeup the bulk of power in the grid for all the space systems.



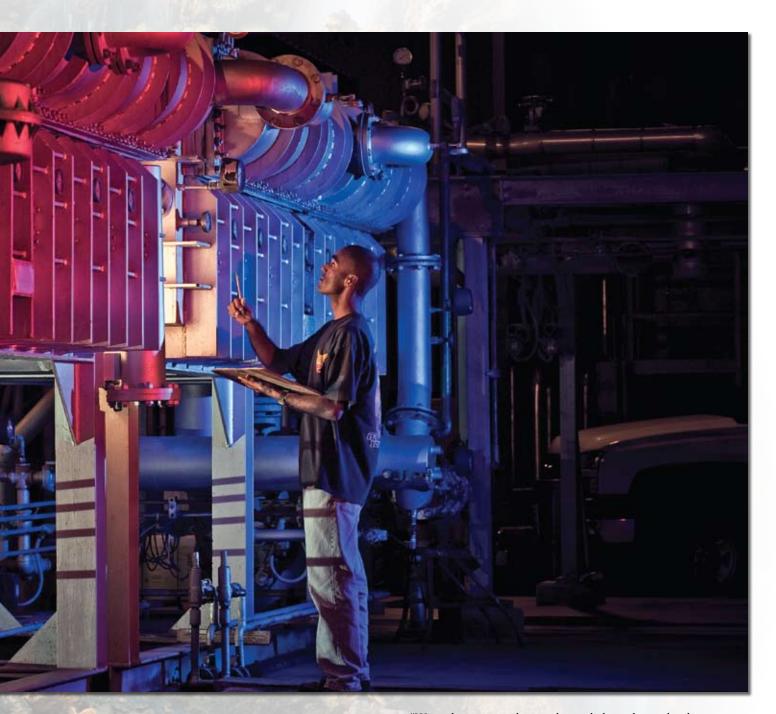
ALL NATURAL

But the base isn't only using wind to help power its grid. It's also using the sun. Located near the flightline, the base installed a solar farm several rows of sun-absorbing panels – that powers the lights lining the runway. Excess energy flows into the main base power grid. Aside from periodically checking circuits, the solar panels only need a dusting every now and again, to keep them operating at their best.

Atop dormitories, two door-sized water heater panels use solar energy to ensure everyone has hot showers when they want it. All of the exit lights in the base's buildings were switched to LED versions. This and other types of light replacements were made simpler with direct replacements that industry already had available. Compact fluorescent light, or CFL, bulbs use less-power, but the biggest savings is in the higher reliability, longer life and lower maintenance costs.

"When it comes to energy conservation, it's the little things, like light bulbs, that make a difference," Henning said.

And the base's environmental attitude doesn't stop there. "We don't only use wind and solar power. We also have several conservation programs here on the island," said Major Block.



"This island was here a long time before we were. The idea is to make sure it's here a long time after we're gone." - Frances Dixon

These programs include plant eradication of aggressive non-indigenous plants and the conservation of several plants that are only found on the island.

Efforts to protect one of the island's annual visitors, the green sea turtle, are part of the base's stewardship plan. These large oceandwelling turtles come to the island every spring to mate and lay eggs on its beaches. This is significant because the turtles only come ashore to lay their eggs in a few places around the world.

"We make sure people are educated about the turtles, learn to respect them and know how to act around them," said Frances Dixon, leader of the base environmental engineering team.

So, while the people on the base use natural energy to help power the facilities, they also ensure they remember to take care of the natural surroundings.

"This island was here a long time before we were," said Dixon. "The idea is to make sure it's here a long time after we're gone."

WATER IN A FLASH

On the swing shift, every hour on the hour, Darrell Richards, a desalination plant operator, walks through a maze of boilers and hot insulated pipes filled with steam and water. His destination, a bussized flash distiller lined with thermometers recording the production of clean water.

The flash desalination process starts with saline (salt) water heated to more than 200 degrees by a steam boiler, then piped into a series of 16 total vessels. Each vessel has less pressure; the change causes flash boiling without the need to supply additional heat. The

fresh water vapor is captured in the upper part of the chamber and is piped into the base water system. Generally, 340 gallons of water are produced each minute. The desalination plant is designed to produce 30,000 gallons of clean fresh water every day. What does not become clean water is brine that is piped off the island.

Pure water through desalination is expensive compared to natural freshwater sources, but on a remote island it is the most cost effective process.

"By December, our distiller will be replaced with a reverse osmosis plant that will reduce our fuel usage by an average of 1,000 gallons per day with the added benefit of reducing our carbon footprint," said Henning. "The amount of electrical usage for the plant is comparable to the distiller, less the cost of heating boilers."

ZERO IMPACT

On the south end of the island, every six hours sanitized water flows out of a pipe and into a tide pool. Not too abnormal for a place with humans nearby. Only six hours before, it was wastewater from the base's housing and industrial areas. The key is an army of microscopic organisms living in the tanks of the wastewater treatment plant. They breakdown the organic waste; solids then sink or float; in between is water nearly ready to be pumped out to the pool. A few tests and pH adjustments with chlorine to balance batches of water returning to the ocean resource result in zero impact. The plant currently averages 37,000 gallons of processed wastewater every 24 hours.

IN THE SPOTLIGHT

The environmental achievements accomplished on Ascension Island aren't going unnoticed, either. The base has received numerous awards, the most recent of which was the 2008 Gen. Thomas D. White Environmental Quality Award for an overseas base.

This award is presented by the Air Force chief of staff to officials of an installation located outside the United States who

Sanitized runoff flows from the wastewater treatment plant at the airfield. The environmental impact of seawater use on the island, which is balanced due to a desalination process, has no negative effects on the ecosystem.



Solar panels are the sole source of energy for the runway lights at the Ascension Auxiliary Airfield. The AAF's award winning self-sufficiency solutions also include nearby wind turbines, drinking water production and waste water treatment.

demonstrate exceptional environmental achievement.

"We have a great relationship with the people of Ascension and the Royal Air Force," said Major Block. "We've worked hand-inhand to accomplish a lot of our environmental and conservation programs."

Base leaders don't just look at these accolades as awards. They are proof positive that renewable energy does work and can make a significant difference.

"That's really what this is all about," said Hennings. "Sure, saving money is nice, but showing that wind and solar energy work will hopefully make other people and other bases think, 'Hey, maybe we should look into that."

Those words have been taken to heart and for many years (see Partner Profile), engineers and designers have been looking at not only Ascension, but also each other to help determine and design systems that will work for the next site.





PARTNER PROFILE

Energy conservation programs throughout the Air Force might be considered alchemy if you could explain them to someone living in the 14th century. The idea of supplying the energy needs of an entire island by harnessing the wind, storing the energy of the sun or exploiting the energy of hydrogen might seem to be more like a quest to turn lead into gold than reality. Yet, these and other energy conservation programs are saving the Air Force "gold" each year and are the reason the Air Force is a leader in the use of renewable energy.

Energy needs vary from installation to installation and depend upon the base's mission and geography. Windmill farms may be a good solution at some locations but pose a potential hazard at others. Because of this, green energy takes a grass-roots approach with tailored programs for each base. Many installations are participating in the Environmental Protection Agency's Green Power Partnership.

At Minot Air Force Base, N.D., the minus 40 degree winters require huge amounts of energy to heat buildings but more than 65 percent of the base's annual electricity load is supplied from green energy. A local utility uses wind turbines located

near the base to supply much of the needed electricity, but to get the most out of that green energy, base leadership has invested in geothermal heating to boost efficiency.

Dyess AFB, Texas, is also harnessing the power of the wind. In fact, Dyess AFB was one of the first Air Force installations to purchase renewable power and was a Green Power Partner in 2003 when it was the largest purchaser of green power at a single site for the nation. Currently, all electricity on the base is green and pollution-free. Base leaders have also made water conservation a priority using effluent water for irrigation and even freezing it at night to cool dormitories during the day.

The purchase of green energy doesn't just protect the environment since the money bases spend on procuring green energy supports local economies such as at Fairchild AFB, Wash., which supplies nearly all of its electricity needs through green energy. One of the base leadership's goals in utilizing green energy is the support of local wind farms in the region and their pride in being good stewards of the environment. Ellsworth AFB, S.D. also supports the local economy purchasing the output from a 750-kilowatt wind turbine owned and operated by the Rosebud Sioux Tribe.

green power. For example, the base's green power purchase significantly mitigated the energy price increases associated with the 2001 California energy crisis. The base estimates that its five-year purchase agreement has saved \$42 million.

Conserving resources is important for bases to consider especially when the installation is remote. For a paradise like Hickam AFB, Hawaii, the need to conserve fuel is a major consideration since it lies more than 2,500 miles away from the nearest oil pipeline. To meet its needs, base



The largest photovoltaic solar power plant in the United States is located at Nellis Air Force Base, Nev. The array is made up of about 70,000 panels spread over more than 140 acres. When completed, the solar arrays will produce 15 megawatts of power.

Some installations look to the sun for a source of energy. Nellis AFB, Nev., is home to North America's largest photovoltaic power system which saves the base more than \$1 million each year. The solar farm, composed of about 70,000 individual panels, covers more than 140 acres and will supply between 20 and 30 percent of the base's total energy needs.

Edwards AFB in California currently purchases enough green power to meet 60 percent of its power needs. In addition to demonstrating its strong environmental leadership, the base has also achieved financial benefits associated with the use of

leaders have constructed the service's first hydrogen fuel generation and dispensing station. This hydrogen fuel burns cleaner than gasoline, the only exhaust is water vapor, and is produced using solar power. The fueling station will be used by flightline maintenance personnel.

These real energy needs are being met and made more efficient through innovative programs developed by leaders at the base level. After all, it's up to the installation commander to write the check for the power bill and he or she can't just turn lead into gold.

- By Staff Sgt. J. Paul Croxon

POWERHOUSE OPERATOR/MECHANIC ASSOCIATE

Damien C. Cuello Jr.



Growing up and throughout my adult life I always tried to be kind to Mother Nature. In Hawaii, parents and grand-parents taught children to always take care of the land and ocean. If you do, both will provide for you. Now that I am working with renewable energy resources out here on Ascension Island, I think my life is coming full circle. I'm doing what my ancestors have done.

HOME UNIT/BASE:

Computer Sciences Raytheon 45th Space Wing Patrick Air Force Base, Fla.

WORK BASE:

Ascension Auxiliary Air Field Ascension Island April 2005 - present

HOMETOWN:

Tualatin, Ore.

MILITARY EXPERIENCE: U.S. Air Force, 1978-1992



THE F-35 LIGHTNING II: LATEST ADDITION TO AIR FORCE FLE



here's a lot of buzz surrounding the F-35 Lightning II.

One look is all people need to see why.

Commonly referred to as the Joint Strike Fighter, the F-35 contains such a laundry list of high-tech gadgets and never-before-seen capabilities that it sends computer geeks into a frenzy of excitement. Aviation enthusiasts froth at the mouth when speaking of the F-35 and pilots everywhere dream of flying this new fighter aircraft.

But, these air and desk jockeys will all have to wait. The F-35 is not operational.

Yet.

"We expect the F-35 to be operationally capable by 2013," said Col. Gary Cooper II, F-35 combined test director.

Developed by Lockheed Martin Aeronautics Company, the F-35 is single-engine fighter designed to be an affordable, state-of-the-art replacement for air-to-ground aircraft such as the Navy's F/A-18 Hornet, A-10 Thunderbolt II and the F-16C Fighting Falcon.

It has improved combat maneuverability over present fighters, it has increased range and the heads-up display is not viewed in the cockpit but inside the pilot's helmet visor.

This may sound like the stuff of science fiction, but it isn't.

It's the reality of combat aviation.

Its capabilities make the F-35 a much anticipated aircraft. For people involved with the production and testing of the fighter, this eagerness must be tempered with patience.

They won't be pushed, bullied or bartered into making the F-35 operational even one second before they know it should be. The program, and making sure it's done right are just too important.

"We've got to get the testing right," said Maj. Gen. Stephen T. Sargeant, AFOTEC commander at Kirtland Air Force Base, N.M. "We want to make sure this aircraft is 100 percent ready when we deliver it to the fleet."

To do this, the F-35 team is using all the resources at its disposal.

"We're using lessons learned from the F-22 (Raptor) and other aircraft and incorporating them into this program to make it as successful as possible," said Colonel Cooper.

The similarities between the F-35 and F-22 programs are many. They are both fifth generation fighters, they both use the latest and greatest technology and they both are surrounded in an air of mystery.

But there is one striking difference.

The F-35 isn't only being produced for the U.S. Air Force, It's a joint fighter and it's being produced for the Air Force, the Navy,



An F-35 Lightning II is constructed on the assembly line at the Lockheed Martin Aeronautics Company in Fort Worth, Texas. The aircraft will receive embedded antennas, aligned edges, internal weapons and special coatings and materials, the F-35 is able to pick and choose engagements, while remaining virtually undetected by enemy defense systems or aircraft.



the Marines and eight partner nations, including Great Britain, Australia and the Netherlands.

Having so many nations using the same aircraft means greater support capabilities and initial involvement in the design, development and testing of the JSF.

"This is the first time a program like this has been undertaken," said Royal Air Force Wing Cmdr. Chris Forrester, who is part of a team from Great Britain working on the F-35 program. "This aircraft is a joint endeavor in the truest sense. You have various military and

"Having an aircraft that's hard to see means it's more survivable and more lethal." — Colonel Cooper



civilian agencies all working together to create a modern system we all will use. It's really quite exciting."

There's a lot to be excited about. The program is advancing rapidly and its teams already know their work is paying off. The F-35 has flown several successful test flights, the first of which took place in December of 2006.

"Overall, I was impressed by how well the entire first flight came together," said Jon Beesley, Lockheed Martin's chief test pilot for the F-35. "The test team told me I taxied out to the end of the runway much faster than I did for any of the taxi tests. But I was ready to go and so was the airplane. And it was a thrill to fly."

Much of this is due to the fighter's advanced avionics, advances that give the F-35 greater agility and the ability to outperform opposing forces with unmatched aerial maneuvering.

"This is the first real electric jet," Beesley said. "The flight control actuators, while they have internal closed-loop hydraulic systems, are controlled and driven by electricity, not hydraulics.



The F-35 Lightning II Joint Strike Fighter program's Cooperative Avionics Test Bed is specially modified to perform mission systems testing for the F-35 program and accommodates the full array of avionics that will be installed on an F-35.

The F-35 is the only military aircraft flying with such a system." The F-35 isn't just agile. It's also stealthy. With embedded antennas, aligned edges, internal weapons and fuel, and special coatings and materials, the F-35 is able to pick and choose engagements, while remaining virtually undetected by enemy defense systems or aircraft.

"This ability speaks for itself," Colonel Cooper said. "Having an aircraft that's hard to see means it's more survivable and more lethal."

And, even though the enemy can't see it, the F-35 can definitely see them. The Lightning II features the most powerful integrated sensor package of any fighter aircraft to date. This package allows pilots to see a 360-degree view of the battlefield, meaning they have unparalleled awareness and information gathering capabilities.

The F-35 is being produced in three different versions: A conventional takeoff and landing variant, a short takeoff, vertical landing variant and a variant that is able to takeoff and land on an aircraft carrier.

With all of its revolutionary advancements, the F-35 combines the capabilities of the A-10, the F/A-18, the F-16, the AV-8B Harrier and the F-117 Nighthawk into one fifth generation, multi-role fighter.

It's almost like flying a computer.

But, nothing about this sophisticated aircraft is a game. It's all business, and its business is keeping the Air Force a dominant air power far into the future.





The men and women at the Air Force Operational Test and Evaluation Center, located at Kirtland Air Force Base, N. M., do just what their organization's name says. For more than 30 years, they have tested and evaluated new weapon systems or technol-

These tests reduce the risks associated with new technologies and make sure they deliver what they say they can in the least amount of time and as cheap as possible.

ogies that are introduced to the Air Force.

"AFOTEC is in the right place at the right time to provide the right information to senior acquisition decision makers and the warfighter," said Maj. Gen. Stephen T. Sargeant, AFOTEC commander. "Our primary purpose is to support America's fighting forces whose mission is to defend and protect the United States."

AFOTEC specialists are developing a new technology process - from concept to system fielding - and strive to be involved with these programs as early as possible.

"We believe this approach to testing influences a program in a relevant, operational and testable manner," General Sargeant said. "We believe in early influence so that we maintain an operational focus to ensure our combatant commanders have the right tools to win today's and tomorrow's battles."

Once AFOTEC engineers assess a project and determine its feasibility, there are several phases that follow. These include system development and demonstration phase, production and deployment phase and operations and support phase. During each phase, the project undergoes several tests it must pass before placement in the next phase.

"Properly testing systems means they will meet the threats the men and women of the military face every day," General Sargeant said.

AFOTEC currently operates five detachments and 12 operating locations across the United States.

By Staff Sgt. Matthew Bates





efore 1947, people wondered if breaking the sound barrier was possible. The pilots who attempted it experienced uncontrollable shaking and battering of their aircraft by atmospheric pressures while approaching the speed of sound. Sometimes it caused the loss of aircraft and pilots.

On Oct. 14, 1947, then Capt. Chuck Yeager broke the sound barrier at more than 650 mph with his bullet shaped Bell X-1 aircraft after it was released from the bomb bay of a modified B-29 Superfortress at 20,000 feet over Edwards Air Force Base, Calif.

"The X-1 began racing toward the heavens, leaving the B-29 and the P-80 far behind," retired Brig. Gen. Yeager said for a story describing his account of the event for Popular Mechanics magazine. "I then ignited chambers No. 2 and No. 4, and under a full 6000 pounds of thrust, the little rocket plane accelerated instantly, leaving a contrail of fire and exhaust."

"From .83 Mach to .92 Mach, I was busily engaged testing stabilizer effectiveness," General Yeager said. "The rudder and elevator lost their grip on the thinning air, but the stabilizer still proved effective, even as speed increased to .95 Mach. At 35,000 feet., I shut down two of the chambers and continued to climb on the remaining two. We were really hauling," said General Yeager.

"The airplane was allowed to continue to accelerate until an indication of .965 on the cockpit Mach meter was obtained," he said. "At this indication, the meter momentarily stopped and then jumped up to 1.06, and the hesitation was assumed to be caused by the effect of shock waves on the static source."

"I had flown at supersonic speeds for 18 seconds. There was no buffet, no jolt, and no shock. Above all, no brick wall to smash into. I was alive," the general said.

Traveling at that speed General Yeager didn't hear the first man-made sonic boom, but the people at Edwards AFB several thousand feet below him did.

Now, 62 years later, sonic booms are a common occurrence at Edwards AFB where aircraft tests are performed daily by flight

On Oct. 14, 1947, then Capt. Chuck Yeager broke the sound barrier at more than 650 mph with his bullet shaped Bell X-1 aircraft.

test center Airmen and contractors dedicated to improving the tools of the warfighter.

"Ultimately what we do is we support the warrior," said Lt. Col. Dave Smith, the installation inspector general and B-52 Stratofortress test navigator. "We do nothing and everything here for the Air Force; in other words by nothing, we don't have pilots that fly combat missions from Edwards out there and we don't send experimental aircraft into harm's way, but every aircraft that goes into harm's way is carrying systems that we have verified here at the flight test center.'

"If you're an aircraft and you are in the U.S. inventory, in one way, shape or form the flight test center has touched you," Colonel Smith said. "We have improved your avionics, improved your propulsion, airframe and we may have been involved in the fundamental design and delivery of the aircraft itself. In some way we have touched every system out there with the warfighter.'

Colonel Smith is involved with the testing of several B-52 upgrades currently in progress. He said the major upgrade recently completed is the B-52's Avionics Midlife Improvement involving upgrades to the plane's avionics systems.

"Although it (the B-52) is an old system, it's a system with



Staff Sgt. Daphne Jaehn (left) performs a loading procedures test on a F-22 Raptor while Tech. Sgt. David VanCamp evaluates her progress. Both are weapon loaders from the 412th Aircraft Maintenance Squadron.



The Flight Test Center is currently testing legacy Hercules C-130 aircraft which have undergone the Avionics Modernization Program such as the one above. The new cockpit includes upgrades such as dual heads-up displays and full automation and digital glass.

remarkable strength and structural integrity – very well built, it's a horse and it's a tank out there. To keep that horse of an aircraft capable we've got to upgrade the technology inside of it; the avionics that allow us to operate it effectively in today's joint battle space," Colonel Smith said.

"These AMI modifications give us that capability," Colonel Smith said. "They allow us a very high degree of targeting accuracy, which provides huge lethal combat effects for the weapons we can carry while minimizing the damage to friendly structures or forces. It also provides increased capabilities of the crew to prosecute targets we weren't able to attack before."

These new highly accurate targeting capabilities are because of a new targeting pod still being tested

a new targeting pod still being tested by the flight test center staff.

"In the past the B-52 was an area aimer," Colonel Smith said. "We were the guys who would take out the city or the refinery; now we can take out that tank, that bridge, that forward support element. We didn't have that capability years ago. The new software, the new avionics and the targeting pod gives us the capability to get a full joint force multiplier in this 50 year old platform."

Colonel Smith said these modifications have the capability to be upgraded as technology changes and will keep the B-52 maintainable and supportable well into the next 20 to 30 years.

His involvement with the B-52 and test community has been a dream of his since childhood reading stories about X-series aircraft flying faster than anyone at the time. He said, if you love airplanes, working at Edwards AFB is like being a kid in a candy store because of the variety of aircraft being tested.

Another airplane in the "candy store" receiving a new avionics system upgrade is the F-22 Raptor.

"A new avionics system allows for better pilot interface with displays and with air to ground targeting," said Tech. Sgt. Chad Calahan, an F-22 flight test center crew chief. "It allows us to have better use of the small diameter bomb. It also improves the air-frame by allowing us to go up with more bombs that are smaller, so we have less collateral damage."

Sergeant Calahan takes pleasure in working on the F-22 in a testing environment and likes the handiness of a new system called a Portable Maintenance Aid to troubleshoot problems with the F-22's systems.

"They've taken a lot of troubleshooting out of this airplane and put it in with this PMA computer," Sergeant Calahan said. "It will actually kick out a code and does the trouble shooting for you. The airplane will tell it what's wrong. It will tell you, according to the failure report code we get, which component is failing.

Everything is built into one device we can use with the airplane that interfaces with the airplane," Sergeant Calahan said."

Sergeant Calahan has worked on the F-15 Eagle for almost ten years before working with the F-22 and notices a big difference in avionics characteristics.

"From a crew chief standpoint, every component has been easier than the F-15," Sergeant Calahan said. "They've done many improvements with the hydraulic components and changing the engine out is a lot easier than the F-15."

— Sergeant Calahan

in combat."

"The rewarding part

they're going to use

of being involved with

test is we're preparing

the warfighter for what

To him the aircraft is easier to work but also comes with the sobering realization of how important his job is when he considers the big picture.

"The rewarding part of being involved with testing is we're preparing the warfighter for what they're going to use in combat," Sergeant Calahan said. "We're out here putting our pilots at risk, testing and pushing the envelope. Pilots that are going to war know that envelope and know not to go beyond it. We get to see the test complete and [the] successful test missions and we know it's going to go the operational Air Force."

It takes a team to accomplish the mission of the Air Force Flight Test Center: Deliver...technology, acquisition, test, sustainment ...



Staff Sgt. Sean Hurst replaces a module in the Common Integrated Processer on an F-22 Raptor.



A B-52 Stratofortress takes off from Edwards Air Force Base, Calif., on a flight test of its new avionics system. The new system is part of the B-52 Avionics Midlife Improvement program.

expeditionary capabilities to the warfighter.

"We work with Lockheed, Boeing (contractors) and civil service so we get a general scope of everything. We can use each other's skills and they mesh together," Sergeant Calahan said.

Civilian contractors and Airmen work together to test new aircraft like the F-22, B-2 Spirit and expand the life and functions of older aircraft like the B-52 and C-130 Hercules.

The center's C-130 Avionics Modernization Program will be expanding the life of the aircraft approximately 30 years while upgrading the flight deck to include two heads up displays, increased radio capability, full automation and digital glass while decreasing the size of crew.

"This (C-130 AMP) has definitely taken us into an entire new generation of the C-130," said Master Sgt. Dan Halverstadt, a loadmaster and superintendent for operations group standards and evaluation.

"The pilots are able to fly the route with the heads up display so they're looking straight out of the aircraft and not have to look down for the most part," Sergeant Halverstadt said. "We've actually been able to eliminate the navigator from the aircraft so now we're down to a three person flight deck."

"The C-130 AMP aircraft will leave developmental testing in October and will begin operational testing shortly after," Sergeant Halverstadt said. "At some point all Legacy C-130 models in the fleet will be 'Amped' so we can all share the same aircraft."

"We only have 11 loadmasters, three flight engineers and seven boom operators total on this base, we are designing everything for airlift for the future," Sergeant Halverstadt said. "The decisions we make between all of us impact the future of the Air Force for the next 40 years."

The decisions made after testing aircraft and reports filed by all the men and women of the center, affects the future of the Air Force and the outcome of the war. And Maj. Gen. David J. Eichhorn, the commander of the Air Force Flight Test Center, knows how important the task is.

"Proving that weapon systems work as advertised is the mission of the Air Force Flight Test Center at Edwards," General Eichhorn said. "The tools of our trade are forever getting more complex as flying gets easier, but interacting with other systems gets more and more demanding," he said.

"We don't have all the time in the world. We have a finite amount of resources and we test at the limits of the man and machine which is inherently dangerous," the general said.

"Without innovative ideas on how to get the knowledge we desperately need to be intelligent buyers, we'd get little done," said General Eichhorn. "Safely, effectively and efficiently putting sophisticated weapon systems through their paces requires the best and the brightest to create a robust test environment and innovative techniques are a daily occurrence at Edwards."

The ideas, techniques and successes of the center's bright men and women contribute to the triumphs of the warfighter as they are able to arm themselves with knowledge gained from countless tests performed at Edward's AFB and the skies above it - birthplace of the sonic boom.





Off we go into the wild blue yonder

United States Air Force celebrates its

Anniversary
September 18th

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iologists comb the desert floor on the lookout for rocky slopes, washes and the more obvious freshly excavated burrows to find an elusive creature.

The desert tortoise has become more elusive as predators, people and a disappearing habitat put them on the threatened species list.

To keep tortoises from fading from the Mojave Desert surrounding Edwards Air Force Base, Calif., the Head Start program was developed. The program bolsters younger-age tortoises so they may reach adulthood and breed.

Biologists from the base's environmental management office begin by locating female tortoises in the wild when they are carrying eggs in the spring.

"It's a really good feeling to find them," said Mark Bratton, a base environmental management biologist. "It's like finding a pot of gold. They're very hard to find. I can go days or weeks without finding

Once located the tortoises are weighed, X-rayed and taken to large covered enclosures to lay their eggs.

After an X-ray to confirm the last egg was laid, they are released exactly where they were captured but with a radio transmitter attached to their shell so they can be recaptured and used in the program the next year.

After 80 to 120 days of incubation from the heat of the sun the baby tortoises hatch and stay within the protection of the enclosure.

"The pens protect the baby tortoises at the most vulnerable stage of their lives," Mr. Bratton said.

The shells of young tortoises typically don't harden until they are about five years old, and in the wild it is estimated that only two out of every 100 tortoise hatchlings survive into adulthood.

Birds of prey, ravens, snakes, coyotes, foxes and even ants eat the tortoises until their shells harden.

Populations also have declined because of poaching, collection for pets, cars, disease and an ever decreasing habitat because of industry and livestock.

Their slow growth rate and sexual maturity, which takes 15 to 20 years, also poses a problem but biologists are working on a new experiment to hasten their growth.

"We're artificially watering two of the pens to provide more plant growth for the tortoises to eat," Mr. Bratton said. "With more food, they grow faster."

www.AIRMANonline.af.mil



Mark Bratton, a base environmental management biologist, locates an adult female tortoise in her burrow at Edwards Air Force Base.

Generally the tortoises in the watered pens are larger. The scientists are trying to figure out if the larger tortoises have a harder shell than the smaller ones and if they will reach breeding age quicker.

During their journey to learn as much as possible about the tortoise, base biologists have discovered through a paternal study of the relationships of tortoises that all the female tortoises in the study had multiple mates.

Knowing how they reproduce is important for managing the species, said Mr. Bratton. It helps provide a genetic diversity to safeguard the species through time.

Unfortunately the scientists also learned that the tortoises lay relatively few eggs, 3-14 in each clutch, and grow at a rate of 2.5 cm a year.

After studying the animal they determined that from March to October the tortoises emerge in the morning or late afternoon, when the temperature is below 80 degrees, to forage. By November, most



"Our biologists here have every reason to feel very good about what they've done because they've partnered with universities, federal, state and local agencies, even private research, and the things they've learned have added to the body of knowledge about the desert tortoise"—Gary Hatch

"The more we know about the animal the better we're able to find ways to help these young tortoises survive to adulthood," said Gary Hatch, chief of environmental public affairs at Edwards AFB.

Knowing the habits of life in a shell allows better research and makes a difference to the species, especially with the assistance of outside agencies.

"Our biologists here have every reason to feel very good about what they've done because they've partnered with universities, federal, state and local agencies, even private research, and the things they've learned have added to the body of knowledge about the desert tortoise," Mr. Hatch said.

Mr. Hatch and Mr. Bratton engross themselves in their work and find that working with the animals is a labor of love.

"I've always been interested in particularly turtles and tortoises ever since I was a little kid," Mr. Bratton said. "I find it a fascinating animal."

The Head Start program at Edwards AFB began in 2003, as an experimental extension of the Army's Head Start project at nearby Fort Irwin, but is now fully-funded by the Air Force.

Since the late 1980s desert tortoise populations in the Mojave Desert have been on a steady decline, but because of the Head Start program, the tortoises may one day become less elusive near Edwards AFB. Between Fort Irwin and Edwards AFB, biologists from the program have successfully released more than 200 young tortoises with transmitters in the past 10 years.

Though releasing the tortoises is an easier task than finding the ones without transmitters, it sometimes takes Air Force biologists days combing the desert floor, rocky slopes and washes to find them. Those involved with the Head Start program anticipate a time when the tortoise "pots of gold" will be less elusive.



STORY BY JOHN INGLE

TWEETS LEAVE THE SKIES AFTER 50 YEARS, T-37 TWEET RETIRES

lot has changed in the Air Force over the past 50 years. Everything from uniforms to missions have gone through transformations to make the service better as it continues into the future.

Another change met with both skepticism and excitement is the retirement of the T-37 Tweet introductory pilot training jet. It really depends on who you ask as to the effect the retirement will have on training future Airmen warriors, something the T-37 has done for 50 years. That remarkable run for the durable aircraft came to an end July 31 at Sheppard Air Force Base, Texas, when the Tweet was retired from service.

Although bottle-nosed and somewhat of a low-rider compared to other Air Force jets, the Tweet, is a thing of beauty with a harsh high-pitched screech that is unmistakable; especially to a new student pilot entering

Air Force undergraduate pilot training.

Second Lt. Trevor Kernes, the last student to train in the Tweet, said he was honored to be part of the airframe's final training sortie June 17 in the hot North Texas and Southern Oklahoma sky. He said any one of his classmates deserved the opportunity to take part in the final flight. Distracted by the attention, the future Ohio National Guardsman took a moment to reflect on what it meant to be part of that last flight.

"I'm humbled," he said, wiping sweat from his brow. "(But) I'm sorry for the T-6A (Texan II) student pilots because they didn't get to fly the T-37."

More than 78,000 Air Force pilots have trained in the Tweet. That's not counting the thousands of international pilots who have trained at locations across the nation who were introduced to flying jets in the T-37. That number could be larger, but officials only tracked the number of graduates until 1996 when they began keeping aircraft-specific figures.

There are generally two groups of student and instructor pilots at Air Education and Training Command installations that have UPT programs: those who love the Tweet and those who love to hate it. Retired Air Force Reserve Lt. Col. Bo McGowan, the last pilot in the Air Force to surpass 4,000 flying hours in the T-37 alone, spent the last 10 years of his military career providing the foundation of flying to thousands of U.S. and NATO pilots with the Euro-NATO Joint Jet Pilot Training Program.

The unassuming son of a Georgia peanut farmer credited his accomplishment to

being passionate, a drive to succeed and the power to get behind the stick of military jets since his career began in 1984.

"I love flying the airplanes," the colonel said after hitting 4,000 hours in June 2008. "I love flying for the Air Force and I love flying with students."

Other airframes have come and gone since the T-37A first took flight for the Air Force in 1957 - the aircraft was upgraded over the next two years and the T-37B took to the skies in 1959.

The F-4 Phantom first entered U.S. military service in 1960 and was out by 1996, ending its career as primarily a drone for target practice. The F-111 Aardvark first hit the skies for the Air Force in 1967, but was permanently set in chocks by 1998. Granted, these two behemoth airframes were extremely



The T-37 Tweet was the primary jet trainer for more than 78,000 Air Force and multinational pilots. The durable aircraft was officially retired from the Air

Force inventory on July 31, 2009 at Sheppard Air Force Base, Texas.

costly for the Air Force because of the amount of fuel used to keep them going. But, the Tweet entered service much earlier in the jet age than the F-4 and F-111.

Perhaps what kept the T-37 airworthy over the years were the maintainers during its 50-year history.

Two of the longest serving crew chiefs on the flight line, Steve Chandler and Doris Castle, praised the T-37 in April 2008 for its sustainability since pilot training began at the wing in the 1960s.

"The 37 has definitely been a workhorse. It's a tough airplane," said Mr. Chandler, a 25-year veteran crew chief. "That's a long time for an aircraft."

Mr. Chandler and Ms. Castle, also a 25-year veteran crew chief, said they've seen everything from bird strikes to hail dents to rough landings throughout their years on the flight line. But contracted maintenance personnel have always been able to get the plane back on the line and ready for training.

As crew chiefs at Sheppard AFB and AETC Crew Chief of the Year recipients, they've both enjoyed the opportunity to go up in the aircraft and experience what students and instructor pilots endure every day. It's also given them insight to the Air Force's lead-in trainer for undergraduate pilot training.

"The aerobatics the plane is put through by the pilots—I think the aircraft has been a very good trainer for the Air Force," Ms. Castle said. "They've definitely gotten their money's worth."

Pilots logged more than 66,000 flying hours at Sheppard AFB, one of the busiest airfields in the country in fiscal 2007, equating to more than 56,000 sorties. When comparing the old workhorse to the new kid on the block, some T-37s have more than 22,000 flying hours to less than 1,000 for base Texan IIs.

Col. Kevin Schneider, the final commander of the 80th Flying Training Wing and ENJJPT before the Tweet retires, said he's excited to learn more about the Texan II. But, he is a bit nostalgic when it comes to seeing the first aircraft he learned to fly in the Air Force leave the inventory.

"The first thought that comes to mind when I think about the T-37 is, 'what an incredibly durable aircraft,'" he said. "The T-37 has been used for training pilots not only for the U.S. Air Force, but for pilots around the world in their initial pilot training."

The colonel provided some insight to the retiring aircraft's durability. He said he spoke

with an instructor pilot who delivered a T-37 to the aircraft boneyard at Davis-Monthan Air Force Base, Ariz.

He said the airplane had been in service for 50 years; had logged 18,000 flight hours; and landed "Code 1" on its final sortie.

"This means the aircraft had no maintenance defects or issues; all it needed was a quick refuel and thorough flight inspection," said Col. Schneider. "It has been the foundation of pilot training for decades."

As the sun sets on one of the Air Force's most successful airframes in terms of durability and "bang for your buck," it's also dawning on the Texan II that looks to be more cost effective and provide better lead-in training to the T-38C Talon. However, whatever is in the Texan II's future, there is one thing that will take it a long time to overcome – the Tweet's heritage.



Lt. Col. Doug Antcliff and 2nd Lt. Trevor Kernes prepare to egress a T-37 Tweet June 17, 2009 at Sheppard Air Force Base, Texas, marking the end of the aircraft's more than 50-year service to the Air Force. More than 78,000 Air Force pilots have trained in the Tweet since 1959.



A T-37 Tweet flies over Lake Amistad during a training mission. After more than 50 years of service as the undergraduate pilot, navigator and tactical navigator trainer, the last Tweet sortie took place June 17, 2009.

STORY BY LT. COL. DAVE SMITH • PHOTO BY MASTER SGT. JACK BRADEN

ANALYZING DREAMS

s a young boy growing up in Hawaii, my father, an Army major, had a subscription to National Geographic. While reading one particular issue of the magazine I was enthralled with the efforts of some crazy people in the high desert of California. They were flying higher and faster than anyone had before in something called the X-15. I waited eagerly for the next issue to get my glossy page update on where we were in this quest for the unknown. To go so high and so fast was amazing. To somehow or someday be a part of that would be a dream come true.

But then life happened and, as with so many other dreams, this one was set aside by the facts and realities of everyday life. I pursued a civilian career in marketing and was enjoying life in the islands when I received a call that my corporation was being right-sized, although not very right for me. My position was being eliminated. I was initially upset, but in that day's mail was a simple brochure that in bold print

on the cover proclaimed "Aim High!"

The rest, as they say, is history.

I did in fact enter the Air Force and became a B-52 Stratofortress navigator. Passionate about the huge bomber and its mission of global deterrence, I progressed through what one might call a normal career path. But eluding me was that persistent thought of touching the mission embraced by those crazy people in California's high desert.

Eventually I did reach into the unknown, but my unknown was the United States Army. I served three years with outstanding Soldiers at the National Training Center at Fort Irwin, Calif. As my tenure was closing, a representative at the Air Force Personnel Center called and offered me my dream assignment, a by-name request to enter the experimental world at the Air Force Flight Test Center at Edwards Air Force Base Calif. Were they joking? I was not a Test Pilot School graduate. But they were serious. The B-52 was going through a mid-life upgrade — interesting that we define middle age as 50 years old— and they wanted my help. I thought about this for the better part of a tenth of a

second and accepted the assignment.

So, maybe dreams can come true.

Entering this world of pushing limits, reaching out further and faster and embracing the unknown was a simple delight. But it's not just an adventure, it's a job, or better stated, a mission. The test community does not exist to simply test stuff. They exist to directly support the real heroes out there, the warfighters. Every system is tested, either in a controlled and disciplined environment where factbased improvements and corrections can be made, or by a tired, hungry, albeit passionate, warrior who bets his or her life on that system

working correctly. I'll take option one.

Recently an exciting opportunity presented itself to me, to test something unique and terribly lethal, the Massive Ordnance Penetrator. This bomb, 30,000 pounds of striking force, is the largest non-nuclear weapon in our inventory. It fills the bomb bay of the mighty B-52 and approaches the length of an F-16 Fighting Falcon fuselage. The people in the 419th Flight Test Squadron — the Global Power Bomber Combined Test Force — are the agents charged with evaluating the characteristics of this huge weapon, and they are doing it in spades. When released to the warfighter it will be another huge capability to ensure we continue to defend this great nation and our way of life.

"Sixty seconds, doors open; thirty seconds, range clear; cleared hot; cleared to arm; pilot's consent; navigator's consent; 10, 9, 8, 7, initiating launch, 3, 2, 1 weapon away."

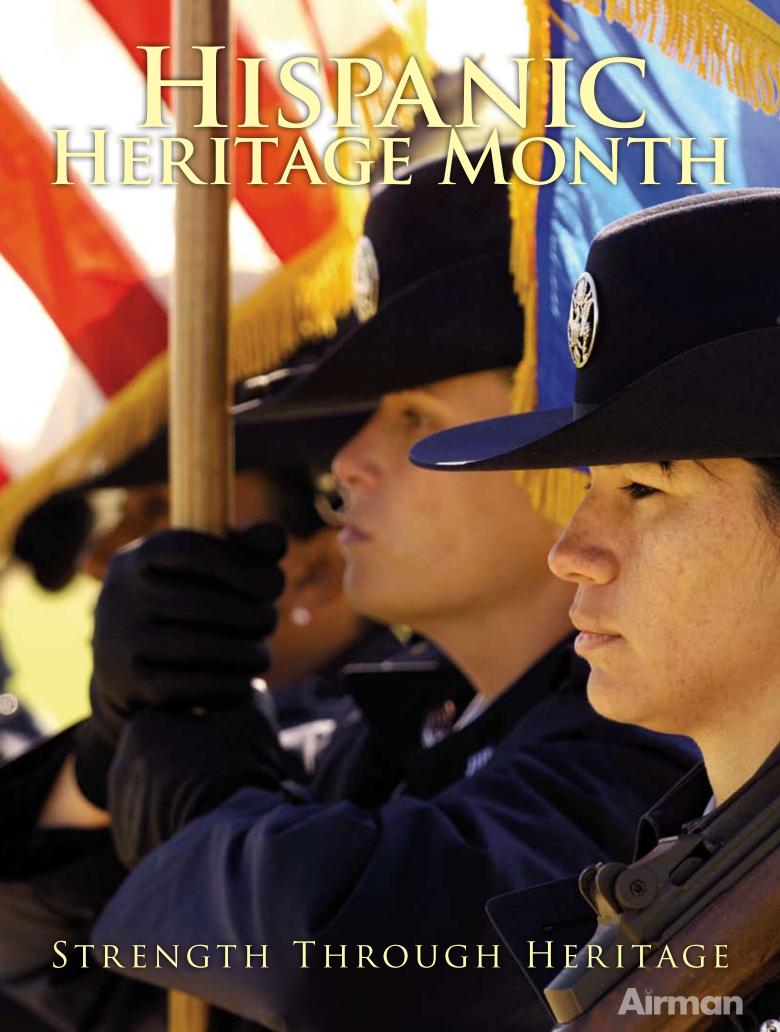
The explosion is tremendous, a mushroom cloud thousands of feet in the sky.
But it also was an unacceptable distance
from the target. A flaw had been discovered, a flaw that if not caught could have
resulted in a combat target missed, or
more horribly, a friendly fratricide. We
did our job. We identified early something that needed fixing, well before
brave Americans placed their lives on
the line in combat.

The passion I saw in those crazy people flying the X-15 is not lost. The flight test community remains passionate in the execution of the test and evaluation mission. Our men and women in combat need us to present them with highly effective systems on cost and on time. The integration of these three features — cost, schedule and performance — must be embraced across all spectrums of the acquisition community because somebody bets his or her life on our work.



Lt. Col. Dave Smith, Edwards Air Force Base installation inspector general and B-52 Stratofortress test navigator, is involved with several B-52 upgrade tests currently in progress.





GOLDEN HOUR. photo by STAFF SGT. SHAWN WEISMILLER
Staff Sgt. William Lawson, pararescueman with the 129th Expeditionary Rescue Squadron, comforts a wounded Afghan National Army Soldier, in Helmand Province, Afghanistan. Sergeant Lawson will provide care to the injured soldier until they can safely deliver him to a hospital.

Airman